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wishing to understand the applications of electricity must first acquire a thorough knowledge of the theory. Having secured this, he will find no trouble in reading any works devoted to the practice of electrical engineering.

#### AMERICAN COASTER'S NAUTICAL ALMANAC.

*The American coaster's nautical almanac for the year 1884.* Published by authority of the secretary of the navy. Washington, Bureau of navigation, 1884. 158 p. 8°.

It has long been customary for the principal dealers in chronometers, hydrographic charts, and navigation supplies generally throughout the country, to publish annually, in cheap pamphlet form, certain of the fundamental data required in the navigation of ships, and compiled largely from the publications of the 'Nautical almanac' office. Such small prints have commonly been disposed of for a few cents per copy, or given away to masters of vessels, as the tabular data were so scattered among advertisements of the wares of these dealers as to render their distribution a matter of interest to the publishers.

The recent action of the superintendent of the 'Nautical almanac' office, in beginning the regular issue of the 'American coaster's nautical almanac,' will, it is to be hoped, put an end to this unauthorized extraction from the publications of the scientific offices of the government; for the new annual will contain, in a compact and convenient form, the ephemeral data of every sort required by navigators along the American Atlantic coast, and is issued under the official sanction of the secretary of the navy. The 'Coaster's almanac' is made up from data already in good part accessible to navigators in one form or another, but which are now, for the first time, brought together into a single small volume, obtainable with little trouble and expense.

We have first the elements pertaining to the position, motion, and apparent magnitude of the sun, together with the equation of time, — all given for Greenwich noon, as in the larger annuals of the same office. Following are the times of the moon's phases, — where, by the way, the meridian is omitted, and a doubt is likely to arise whether they may not be applicable to some meridian other than Greenwich, — underneath which we find the sidereal time of mean noon, and blank columns left for the navigator to enter with every day the

necessary data regarding his chronometer, and the latitude and longitude of his vessel at noon. The next succeeding pages contain the positions of a hundred and fifty fixed stars for the beginning of the year, followed by a table for finding the latitude by an observed altitude of Polaris, and a table for converting solar into sidereal time. A matter of some account is the omission from this portion of the 'Coaster's almanac' of all data regarding the planets. A half-dozen additional pages would have sufficed to give the positions of the four bright planets ordinarily employed by navigators, with precision enough to make them quite as useful as the list of star-positions.

The astronomico-nautical data occupy nearly forty pages, or about one-fourth of the entire book. Following are twenty pages of tidal data, compiled from the complete tide-tables published by the office of the coast and geodetic survey. The approximate predicted times of high water at the principal ports on the Atlantic coast of the United States are given for every day of the year; while, for intermediate ports, tables of tidal constants are added. The times of high water are reduced to the standards of the eastern and central meridians, respectively five hours and six hours slow of Greenwich time.

We have next a very comprehensive list of more than five hundred lighthouses, lighted beacons, and floating lights, on the Atlantic and Gulf coasts of the United States, occupying thirty-five double pages, and giving the name, location, characteristic, and order of each light; also the geographical position, height above the sea-level, maximum distance at which visible, the color and peculiarity of the lighthouse or vessel, and the character of the accompanying fog-signal. This is followed by a ten-page list of lights in the West-India Islands, and on the adjacent coasts, the coast of Brazil, etc., to the Magellan Straits, similar data being likewise given for these lights. The 'Coaster's almanac' concludes with nautical directions for manoeuvring in, and avoiding the centre of, cyclones in the North Atlantic; the twenty-six articles of the revised international regulations for preventing collisions at sea; general information regarding life-saving stations, with instructions to facilitate the shipwrecked mariner in receiving the assistance of these stations; and, finally, descriptions and explanations of the signals displayed by the army signal-service as cautionary against approaching storm, severe winds, and rough weather generally.

The new almanac bears in every part the marks of preparation with a considerate regard for the wants of that class of men likely to use it; and the make-up of its contents has evidently been in large part suggested by, or under the direction of, some officer fully acquainted with the routine and necessities of practical navigation; and subsequent issues may be expected to contain many additional improvements. The 'Coaster's almanac' is not intended to replace the 'American nautical almanac,' or navigator's edition of the large 'Ephemeris,' which has been issued by this office for each year since 1855, and will be continued as heretofore.

#### METALLURGY OF PRIMITIVE NATIONS.

*Die metalle bei den naturvölkern, mit berücksichtigung prähistorischer verhältnisse.* Von R. ANDREE. Leipzig, Veit & Co., 1884. 10+166 p., 57 illustr. 8°.

IN our epoch the primitive status of savage nations rapidly disappears, and the manufacture of the last tools recalling the stone age will soon be abandoned. The factories of New England already furnish cast-steel tomahawks to our western Indians, and the Central-African negro shoots the hippopotamus and elephant with a breech-loader of the most recent pattern. Facts like these are a sufficient warning to the ethnologist for collecting *now* whatever can be brought to posterity from the implements and rude machinery of the lower races of mankind. To aid this purpose, Andree has undertaken to illustrate one branch of ethnologic research, metallurgy, and to show the extent of our present knowledge concerning its practice among the above races.

His learned treatise excludes the European and Semitic nations, of which the metallurgy is sufficiently known, and had, except within the most recent times, but little direct influence upon that of primitive nations. The most important metals to be considered were iron, copper, tin, and bronze. The Egyptians of the earliest period were acquainted with bronze and iron; but the manufacture of iron tools by the Central-Africans was an invention of their own, and not borrowed from Egypt. It first developed in north-eastern or in Central Africa, and from there must have reached southern Africa, as Andree believes. Iron tools followed immediately upon stone tools, since copper is limited to a few portions of that continent only. The East Indies had a stone period for themselves; and metals,

except tin, do not seem to have been imported there. Copper is obtained by very archaic methods. It cannot be decided which metal, copper or iron, is of older use in that country.

The Malayan nations form another independent area or domain of metallurgy, their peculiar practical methods reaching from Madagascar to New Guinea. Iron was their oldest metal, and it probably was so among the Indo-Chinese as well. In its cultural development, China stands wholly for itself, and thirty-five hundred years ago it produced the finest bronzes; but Chinese prehistorics have not as yet been sufficiently studied to decide which metal was the first to be wrought in that distant realm. When Russia invaded Siberia, some of its tribes were reducing and working iron ores, having been probably taught by Turkish nomads. Meteoric iron was put to use by several American tribes, especially by the Eskimo. The reduction of ores by charcoal, and their smelting by fire, were discovered at three different spots in this western hemisphere, wholly independent of each other, — in Mexico, in Cundinamarca, and in Peru. The chief metal of Mexico was copper; of Peru, bronze; though both were used simultaneously with stone implements. Analyses made of American bronzes have proved them to be alloys of metals joined in very different proportions.

The 'Scandinavian' theory, that in every part of the world the metals should appear in the same historic order — copper, tin, bronze, iron — among all, even the most heterogeneous nations, has held supreme sway in science for almost half a century, but is now entirely upset by the investigations of R. Andree and others. A fact which alone would suffice to disprove it is this, that the production of bronze is a more difficult process than the production of iron. Many nations have borrowed metallurgic processes and methods from other nations, as proved in many instances; but these methods and practices have also been the result of inventions independent of each other; and, to explain the similarity of processes in countries widely separated from each other, the assumption of separate invention is the most probable and natural of all.

Although the above results gleaned from Andree's publication give only a superficial idea of its contents, we deem them sufficient for attracting the notice of ethnologists and archeologists, and add the statement that every page of it teems with important or unexpected disclosures.